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Regional Variation in Riblet Frequency in the *Ptychodon* (*Ptychodon*) *hectori-hunuaensis* Complex (Mollusca: Charopidae)

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Abstract

RIBLET frequency in the first post-nuclear whorl has been studied in samples involving the *Ptychodon* (*Ptychodon*) *hectori-hunuaensis* complex. These were collected at 80 localities from the North Cape in the far North to the Nelson District in the north of the South Island. Although intra-zonal variation is considerable, regression lines calculated from North-South zones indicate clinal tendencies.

INTRODUCTION

RIBLET frequency is a statistic commonly employed in the systematics of terrestrial Mollusca. Variation in post-nuclear whorl counts in single populations of a number of New Zealand genera has been studied (Cumber, 1960) and utilized in a revision of the genus *Phenacohelix* (Cumber, 1961). More recently (Cumber, 1962) riblet frequency studies in a species of the genus *Charopa* revealed regional patterns with some hint of a latitudinal cline. The present study was carried out to determine whether the genus *Ptychodon* showed similar tendencies. The statistic employed is the riblet count of the first post-nuclear whorl, which may be readily determined in all but a few of the older specimens. The materials utilized were taken by the author during the past 20 years and involve some 80 collection sites ranging from North Cape to the Nelson district. The species may be collected readily from leaf, etc., held up in the axils of *Rhopalostylis, Astelia* and *Freycinetia*, but occur in most forest litter—especially that held up off the ground in ferns and moss.

RESULTS

Text-fig. 1 indicates the sampling sites, numbers of specimens examined, and the range in riblet count, the sites being grouped into five zones. Four of these comprise North to South divisions of the North Island, the fifth being the Nelson district of the South Island. Text-fig. 2 sums the frequencies within successive zones and indicates the presence of a second species in zones 3–5. Text-fig. 3 shows frequencies for individual samples involving the two species. Text-fig. 4 indicates frequencies encountered in zone 1 (species 1). Fig. 1 shows specimens from a northern low frequency population (species 1), and specimens from a population involving the two species.

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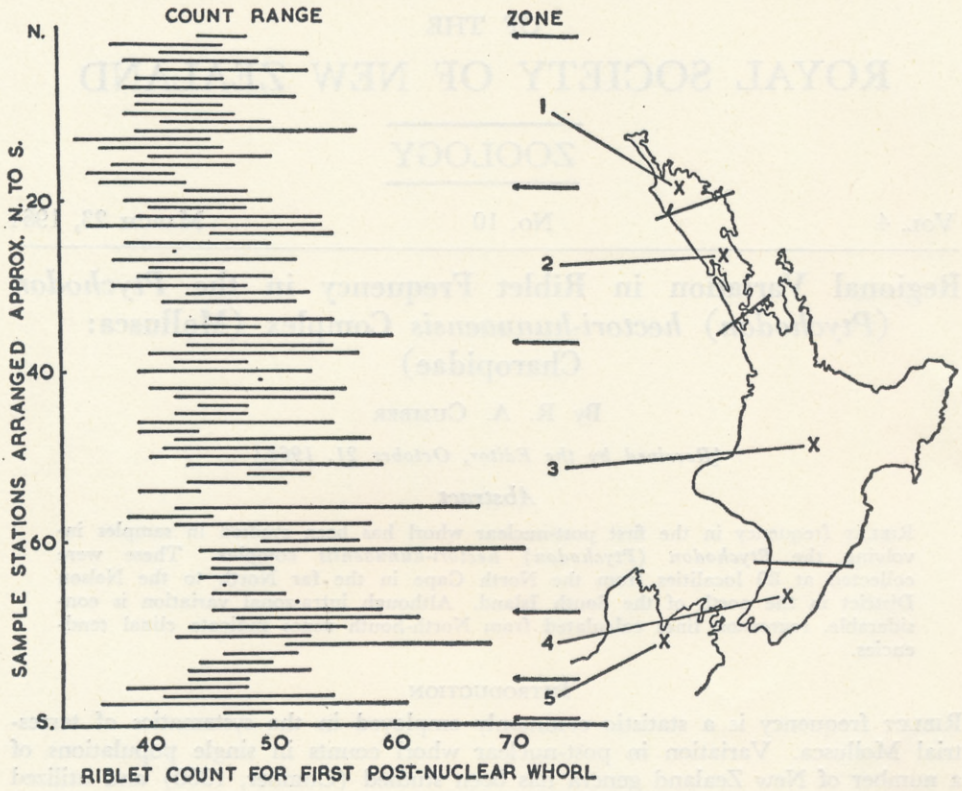


Text-fig. 1.—Count ranges for the first post-nuclear whorl in samples of *P. hectori-hunuaensis* complex taken from the North Cape area in the far north to the Nelson districts in the south, and arranged approximately in that order. 1—Pandora, 13.1.57 (3 specimens); 2—Kohuroa, 3.2.63 (13); 3—Oruaiti, 22.9.58 (25); 4—Otangaroa, 23.2.59 (6); 5—Peria, 29.3.58 (21); 6—Ahipara, 1.10.57 (5); 7—Kaeo, 19.9.58 (32); 8—Mangamuka Gorge (Top), 17.10.62 (78); 9—Waipapa, 17.1.57 (5); 10—Mangamuka Bridge, 23.9.58 (37); 11—Waiare, 19.9.58 (17); 12—Herekino, 22.9.58 (21); 13—Motukaraka, 1.10.57 (17); 41—Mitimiti, 1.10.57 (13); 15—Paihia, 12.1.49 (6); 16—Aramahoe, 19.1.57 (16); 17—Oue, 26.9.59 (6); 18—Omapere (Hokianga), 13.10.57 (23); 19—Waikare (B.O.I.), 24.9.60 (9); 20—Waimatenui, 10.2.59 (9); 21—Moerewa, 20.1.49 (3); 22—Helena Bay, 24.9.58 (43); 23—Waipoua Forest, 26.9.58, 22.10.62 (35); 24—Otonga, 23.9.58 (24); 25—Parakao, 25.5.58, 19.10.62 (17); 26—Bream Head, 6.1.57 (1); 27—Brynderwyn, 24.2.59, 26.3.63 (26); 28—Paparoa, 25.9.58 (15); 29—Maungaturoto, 29.9.58 (24); 30—Kaiwaka, 6.12.48 (20); 31—Wellsford, 13.1.58 (20); 32—Pukapuka, 27.5..63 (20); 33—Mt Auckland, 6.9.62 (1); 34—Silverdale, 18.9.58 (20); 35—Piha, 30.9.58 (11); 36—Waitakere Ra., 13.9.58 (45); 37—Coromandel Peninsula North Cross Road, 6.3.57 (15); 38—Coromandel Peninsula South Cross Road, 5.3.57, 8.7.58 (20); 39—Pollok, 17.9.58 (5); 40—Clevedon, 9.7.58 (20); 41—Whangamata, 1.10.58 (2); 42—Te Aroha, 7.7.58 (20); 43—Kaimai Ra., 5.3.57, 6.11.57 (17); 44—Te Mata, 20.8.58 (2); 45—Pukemiro, 7.3.57 (8); 46—Te Kawa, 19.3.59 (51); 47—Hicks Bay, 11.2.59 (4); 52—Potaka, 13.8.58 (7); 53—Waioeka Gorge, 13.2.57 (15); 54—Te Kuiti, 24.1.57 (3); 55—Whakatane, 14.2.57 (1); 56—Rotoma, 15.2.57 (58); 57—Fitzgerald Glade, 28.9.60 (12); 58—Mapiu, 10.7.58 (20); 59—Gisborne, 11.2.59 (11); 60—Wharerata Ra., 14.11.62 (2); 61—Tangoio Hill, 9.2.59 (31); 62—Awakino Gorge, 13.9.60 (5); 63—Tiniroto, 12.2.57 (4); 64—Pohokura Saddle (Napier-Taupo), 15.2.57 (4); 65—Mt Messenger, 12.11.49 (1); 66—Tarata, 3.4.57 (21); 67—Ohakune, 20.3.59 (1); 68—Wharite, 15.8.58 (22); 69—Waewaepa Ra. (Puketoi), 29.3.57 (5); 70—Pahiatua Track, 29.7.58 (18); 71—Kahuterawa, 27.4.61 (28); 72—Tauherenikau, 1940 (4); 73—Orongorongo Ra., 1940 (7); 74—Porirua, 1940 (3); 75—Haurangi Ra., 14.1.59 (10); 76—Wellington, 1940 (10); 77—Riwaka Valley, 17.10.48 (9); 78—Nelson, —.10.48 (18); 79—Wairoa Gorge, 1948 (28); 80—Ruby Bay, 1948 (3).

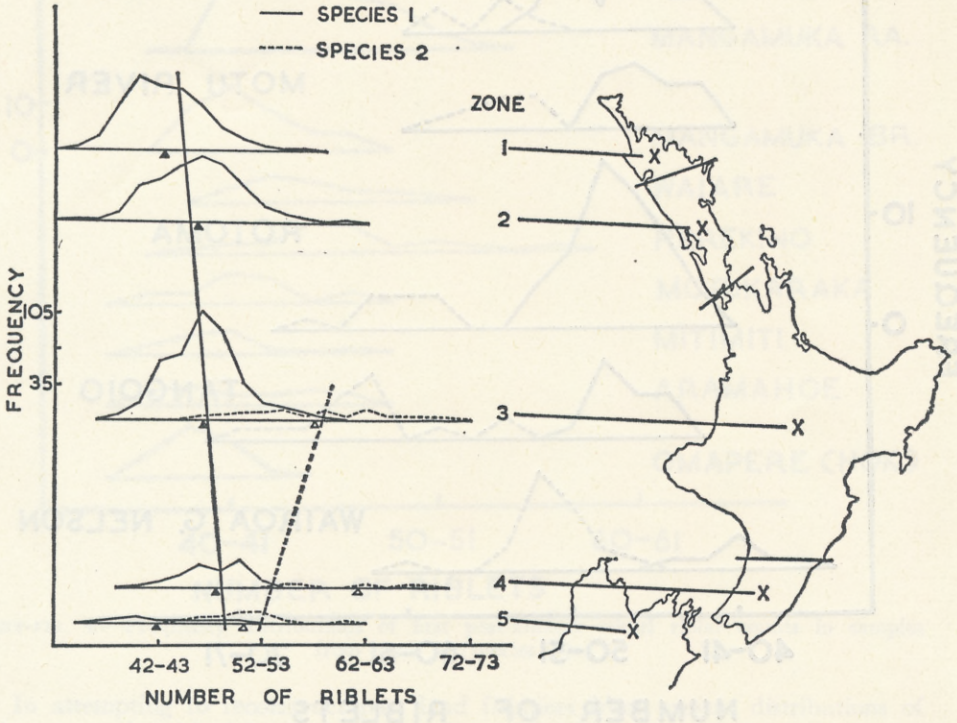
DISCUSSION

The *Ptychodon* (*Ptychodon*) *hectori-hunuaensis* complex, characterized by forms with 2–4 lamellae below the emarginate mid-parietal lamella, has not been critically examined. These studies on regional variation in riblet frequency have revealed the presence of a second species, but the situation is very different from that indicated by existing systematic work (Suter, 1913).

One (species 1) occurs from North Cape to the Nelson districts. The other (species 2) is present from East Cape to Nelson. The southern limits of the complex have not been determined accurately. Suter's southernmost records are Kenepuru.

Separation of the two species is not easy. Although riblet frequencies in the first post-nuclear whorl seldom overlap where the species co-exist, regional variation does not allow an overall separation of materials on this basis. This is clearly illustrated in Text-figs. 2–3. The greater contrast between dark and light areas seen in species 2 is a useful character.

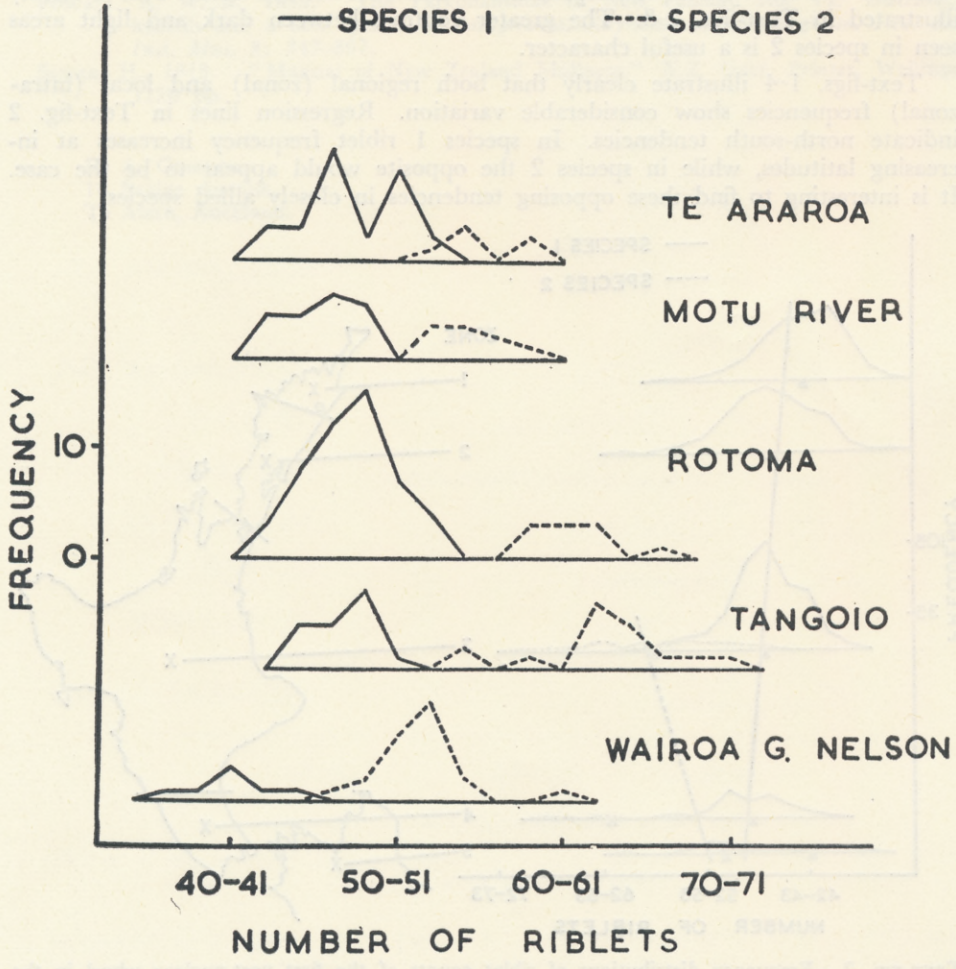
Text-figs. 1–4 illustrate clearly that both regional (zonal) and local (intrazonal) frequencies show considerable variation. Regression lines in Text-fig. 2 indicate north-south tendencies. In species 1 riblet frequency increases at increasing latitudes, while in species 2 the opposite would appear to be the case. It is interesting to find these opposing tendencies in closely allied species.



TEXT-FIG. 2.—Frequency distributions of riblet counts of the first post-nuclear whorl in the *P. hectori-hunuaensis* complex for samples (combined) falling within the indicated zones. These frequencies are spaced in accordance with the strictly north-south distances separating zone centres. The means (triangles) and linear regressions are shown. Zone means and S.E.'s are as follows: Zone 1, 43.1 ± 0.21; 2, 46.1 ± 0.18; 3, lower modality 46.7 ± 0.17, upper modality 57.4 ± 0.78; 4, lower modality 48.0 ± 0.31, upper modality 61.8 ± 2.23; 5, lower modality 42.5 ± 0.93, upper modality 50.8 ± 0.48.

If temperature is of importance in variation of relatively adjacent areas, one would expect evidence for this where altitudes rise suddenly from near sea-level to 2–3,000ft. This is approximately the situation for the samples Mangamuka Gorge (Top) and Mangamuka Bridge (Text-fig. 4), which do show an increased frequency at altitude. However, temperature cannot be divorced from other factors such as humidity, light, and the differing types of vegetation which develop under the differing local conditions.

Riblet frequencies in relatively adjacent populations doubtless vary in some measure in all ribbed pulmonate species. However, where it is possible to show clinal tendencies, the concept of the species may be more firmly established. Good characters for separation are usually difficult to find in closely allied species. Where such species co-exist and separation characters are established, the picture may be clear for the particular population, but the degree of compatibility which



Text-fig. 3.—Frequency distributions of first post-nuclear whorl riblet counts in samples involving the two species.

exists between these species and the other varying populations from throughout the range must without experiment remain a matter of conjecture.

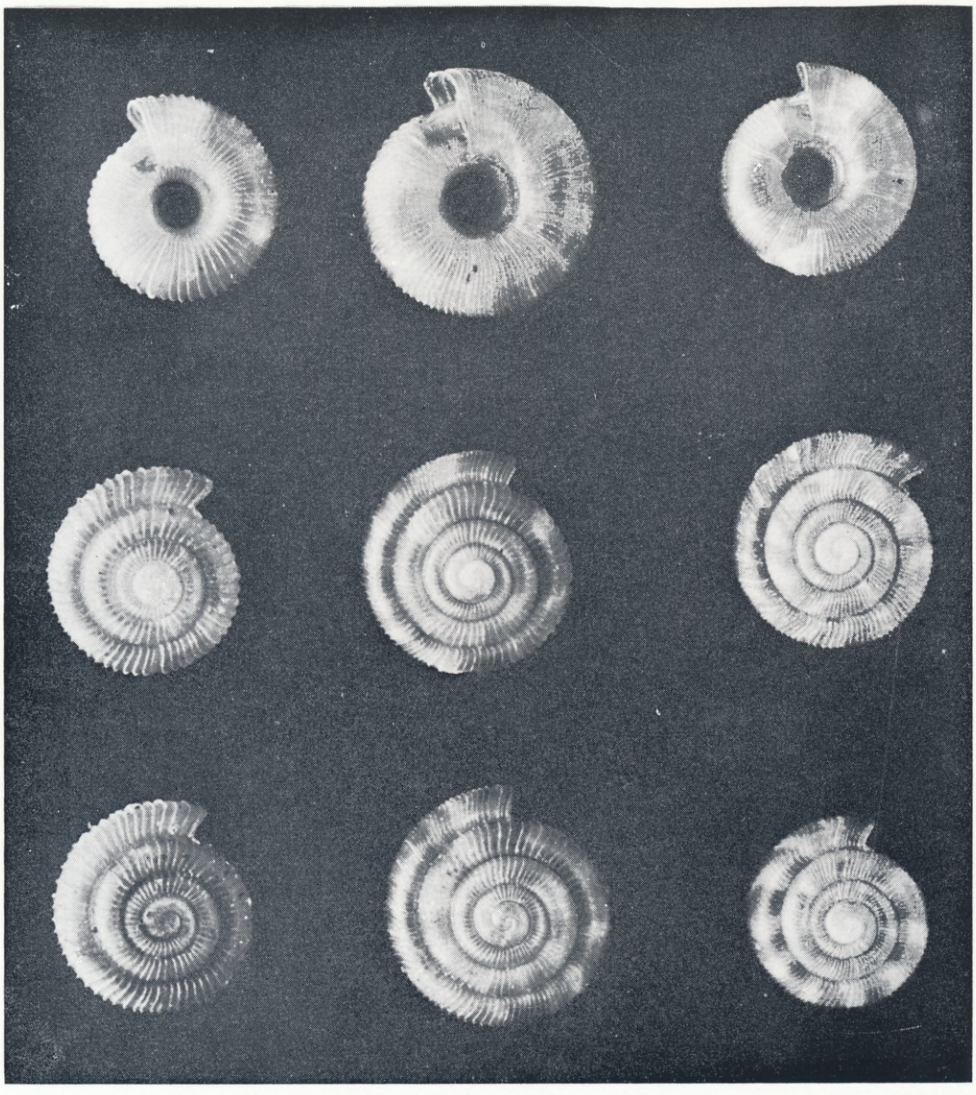
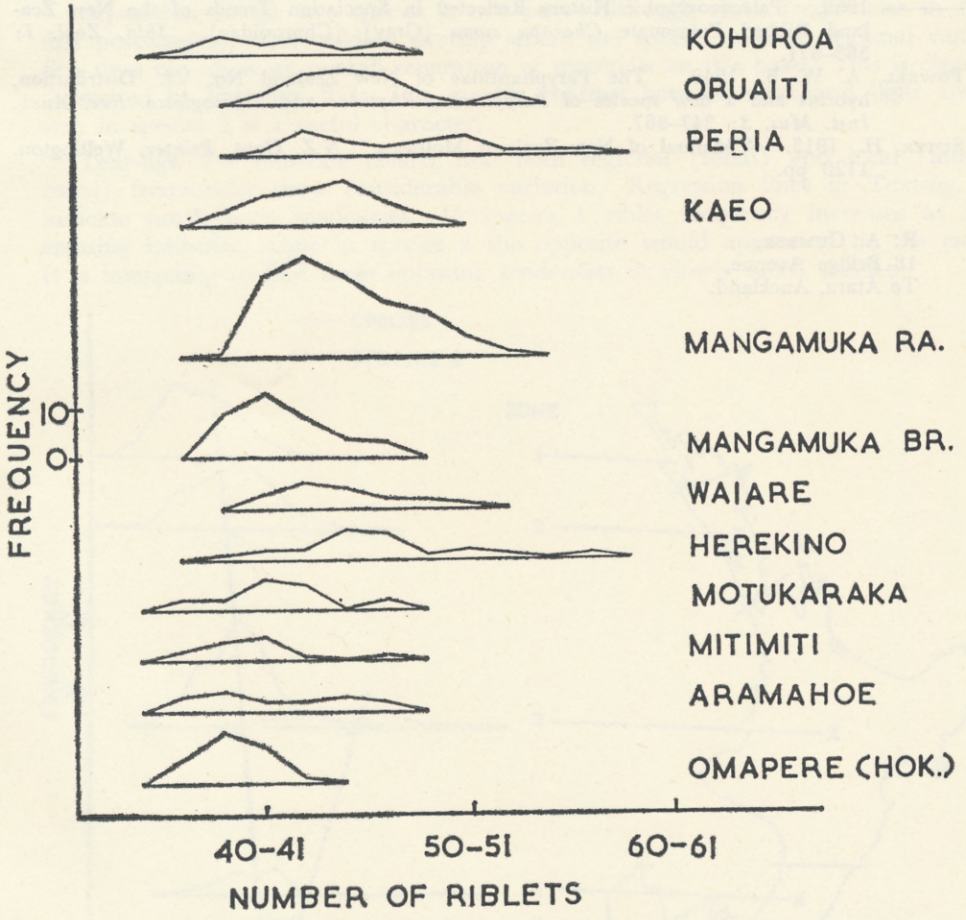


Photo: S. A. Rumsey.

FIG. 1.—A—Species 1 with widely spaced ribbing, Omapere, Hokianga. B, C—Species 1 (B) and 2 (C) from a single population, near Lake Rotoma.

In zonal considerations, boundaries have purposely been sited to give maximum scope to paleogeographic isolation. Despite this, the clinal tendency in species 1 for increasing frequency in progressing southwards is over-riding. The opposite tendency in species 2 is present but less convincing because of the smaller latitudinal range.

The distribution of species 2 suggests that a further zonal boundary running from the mid-Bay of Plenty region to Wanganui may well separate an essentially northern and north-western region to the west, from an essentially south-eastern and southern region to the east, the latter extending to include northern parts of the South Island. Distributions of other pulmonate species support this.



TEXT-FIG. 4.—Frequency distributions of first post-nuclear whorl riblet counts in samples from zone 1 (species 1).

In attempting to reconstruct past land frontiers from present distributions of pulmonates, the principle of the relatively rapid colonization of lower areas and slow colonization of higher areas is all important. The point is well illustrated by Powell (1949), who indicates the importance of moving fresh water as an agent of pulmonate dispersion. There are, especially in the Paryphantidae (*Delos, Rhytida, Schizoglossa*) numbers of paired species differing little in physical characteristics, but having very significant areas of co-existence and non-co-existence.

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